

Remarks

Applicant has amended several of the claims to correct a number of antecedent and grammatical errors discovered in the claims. Entry of this amendment is requested to place the claims in better condition for either allowance or appeal. These amendments raise no new issues.

Pending claims 2, 3, 5-20, 24 and 25 have been rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Publication No. 2001/0051437 to Cruse in view of U.S. Patent No. 6,863,018 to Koizumi et al. and 5,025,135 to Gesche et al. The rejection has been made final.

In the previous Office Action, which was the second non-final action, the claims were rejected as unpatentable over Cruse in view of only Koizumi, et al. In the first Office Action, claims 4, 15-16 had been deemed allowable, with the others rejected as unpatentable over only Cruse, whereupon applicant rewrote claim 1 to include the limitations of claim 4 to expedite prosecution.

The new Gesche et al. reference is cited only as teaching that "in addition to other parameters to be monitored during plasma processing it is also important in all plasma processes to determine the onset of plasma generation", or in other words, that in all plasma processes one would like to know whether one has a plasma or not. But this is only one of the three deficiencies in the two previously cited references Cruse and Koizumi et al. that were pointed out by Applicant in the previous response.

In the previous response, Applicant pointed out that the primary reference Cruse (1) "does not specifically disclose the testing for the existence of a plasma, (2) does not specifically disclose the detection of an intermodulation product of two RF signals in the presence of a plasma, or (3) does not teach that detection for the presence of an intermodulation product, produced by a plasma, of two RF signals will enable the determination of the presence or absence of a plasma to provide for the control of the system in response to the determination". Applicant further noted that Koizumi et al. only adds "the combining of signals prior to coupling into a chamber", with "no teaching by

Koizumi et al. of coupling first RF and second RF signals into a process chamber to produce one or more intermodulation products in the presence of a plasma, and to use the detection of the intermodulation product or products to determine whether or not a plasma is present so as to control the system in response."

The Examiner presently maintains that, in adding the teaching of Gesche et al., "it would have been obvious ... to have provided means for determining that a plasma is present in the chamber in response to detection of intermodulation products and for determining that a plasma is absent from the chamber in absence of the detection of intermodulation products, and for controlling the processing tool in response to the determinations in Cruse and Koizumi et al. as taught by Gesche et al." This conclusion erroneously assumes that [Applicant's point (2) above] the detection of an intermodulation product of two RF signals is taught by one of the references, and that [Applicant's point(3)] such detection of an intermodulation product will enable determination of the presence of absence of a plasma for system control. Neither assumption is correct.

Intermodulation of RF signals is a result of two signals being mixed together, producing additional signals that are not, in general, integer multiples or harmonics of either of the two signals. For example, considering two RF signals f_1 and f_2 to be sine waves of different frequencies that are mixed together, "second-order" intermodulation products are produced at frequencies $f_1 + f_2$ and $f_1 - f_2$; "third-order" intermodulation products are produced at $2f_1 - f_2$ and $2f_2 - f_1$; "fifth-order" intermodulation products are produced at $3f_1 - 2f_2$ and $3f_2 - 2f_1$; etc. Such mixing occurs when the two signals are introduced into a device that responds non-linearly to the signals.

Applicant shows that two signals can be found that, when introduced into a processing chamber, will mix to produce intermodulation products if and only if a plasma is present in the chamber. By looking for and detecting certain intermodulation products, Applicant determines the presence or absence of a plasma to control the processing apparatus and process in response to that determination.

Cruse teaches a control system only in the most general sense. Four sources of information are shown by Cruse as being input to a processor. One source includes optical emissions from the plasma; a second source includes "environmental parameters" (e.g., pressure, etc.) from a chamber; a third source includes "RF parameters" (e.g., reflected power) from the output of an RF bias power supply; and, a fourth source includes "system parameters" (outputs) from a digital controller. In a most general sense, Cruse teaches that information from these sources, whatever it is, can be correlated in a processor to analyze what is going on in the system for use in controlling the process, typically by regulating control parameters. Cruse does not mention the introduction of two RF signals that mix in the presence of a plasma to produce intermodulation products. Even if two RF signals were present in a Cruse system and those signals happened to be mixed in the chamber by the presence of a plasma to produce intermodulation products (of which there is no evidence), Cruse would have to know what to look for and how to interpret what was seen. But Cruse makes no mention of any intermodulation of RF signals by a plasma.

Koizumi et al., as cited in the Office Action, describes the use of a summing amplifier to combine DC and pulsed bias voltages. The concept of RF signals being intermodulated by a plasma does not appear in Koizumi et al.

For the reasons stated above, which apply to all of the claims, it is submitted that the claims, as amended, are patentable. Accordingly, allowance is respectfully requested.

Application No. 10/674,920
Amendment dated December 15, 2006
Reply to Office Action of September 20, 2006

Applicant does not believe that any fees are due in connection with this submission. However, if such extension is due or any other fees are necessary, the Commissioner may consider this to be a request for such and charge any necessary fees to deposit account 23-3000.

Respectfully submitted,

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